

158 THE BASIC OPEN-HEARTH STEEL PROCESS

In discussing example 3, p. 157 (Stahl und Eisen, 1904, p. 1,396), these investigators maintain that the percentage of silica in the slag is the factor on which depends the increase or decrease of the silicon content of the molten metal. They added a large quantity (8 ewts.) of highly siliceous material to a bath of steel, and proved that in spite of the violent cooling of the bath, that although only slowly, a really marked increase of silicon content of the metal occurred.

The examples cited, however, show that the reduction of silica from the slag in acid open-hearth furnaces is of very small extent.

In the basic open-hearth furnace, this is quite impossible, since the large quantities of alkaline earths present do not admit of the occurrence of a concentrated solution of silica, and absolutely all Si which is eliminated from the iron must remain in the slag.

The bases employed alter the structure of the slag completely. Lime and magnesia are at high temperatures more powerful than the remainder of the bases, and they net the latter free and take up the silica themselves. According to the equation:

$\text{FeSiO}_3 + \text{CaO} = \text{SiO}_2\text{Ca} + \text{FeO}$, there results from FeSiO₃ and lime, silicate of lime and ferrous oxide, which latter is soluble in a mixture of lime silicate and iron silicate. The higher the temperature the more iron silicate can be decomposed; the reaction, however, cannot take place completely, inasmuch as the slag would lose its fluidity. The alkaline earths, owing to removing the metallic oxides from combination (with acids) cause manganese protoxide as well as iron protoxide to be more easily and to a greater extent used up by the reducing agents in basic than in acid furnaces. The reduction can be driven to the limit which is fixed by the condition that the lime silicate must remain in the fluid state. But certain amounts of metallic oxides are necessary for this.

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This requires for its oxidation, according to the equation, $2\text{P} + 5\text{O} = \text{P}_2\text{O}_5$ for 1 per cent. P, 29 per cent. O, and yields 2*29 per cent. P_2O_5 . . . (88).